Design and Construction Process Management

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Submitted Abstract

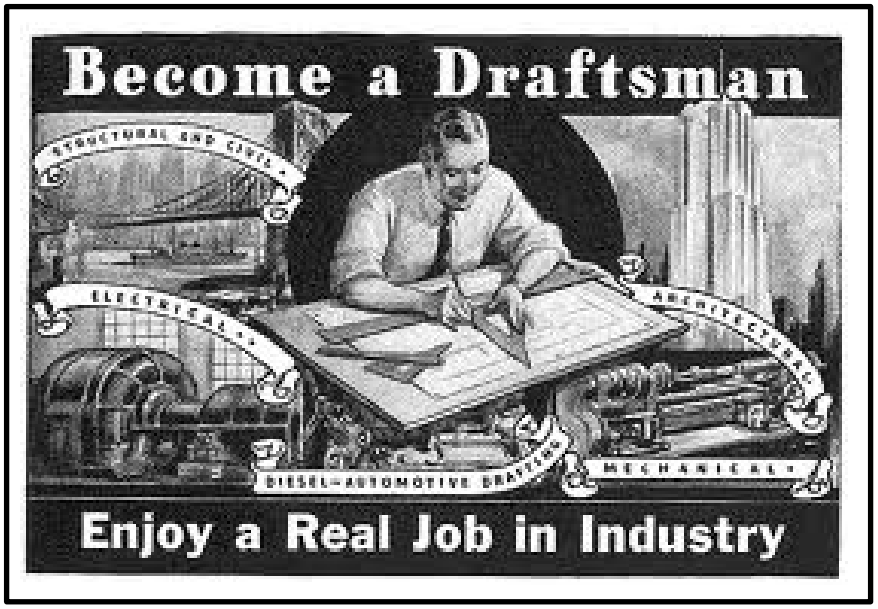
New approaches for improving design and construction processes have been used recently. Innovative methods for managing the requirements and quality of these processes will be discussed. A systematic data centric approach will be discussed as well as the processes of separating progress from performance. It will discuss the integration of these processes in the planning, risk analysis, design, submission, construction, inspection, quality control and documentation phases.

Three Take Away Points…

1. Analog to Digital
2. Progress VS Performance
3. Requirements Management

1. **Analog to Digital**
2. Progress VS Performance
3. Requirements Management

In Design…



ANALOG

DIGITAL

1. **Analog to Digital**
2. Progress VS Performance
3. Requirements Management

In Construction…

ANALOG

DIGITAL

1. **Analog to Digital**
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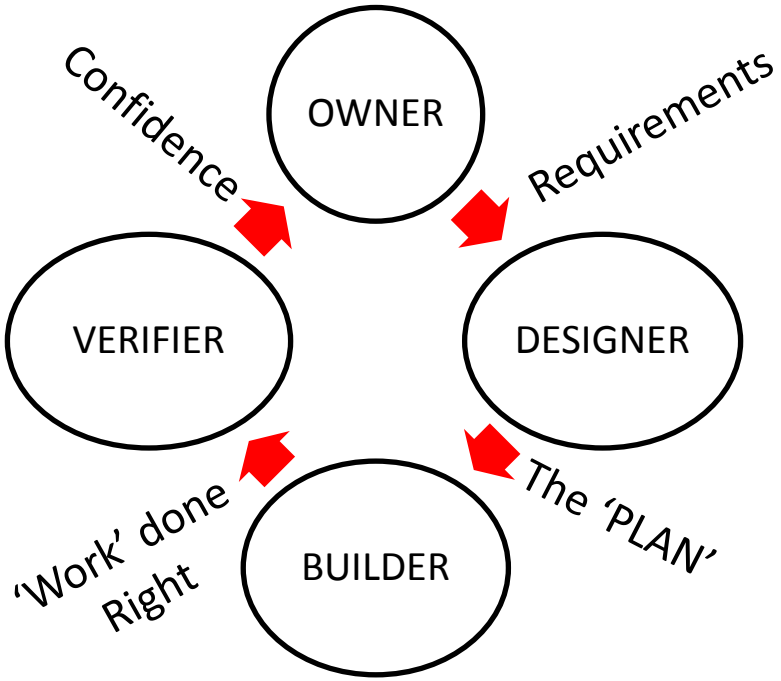
WHY DO WE NEED TO 'CHANGE'?

Understand **WHAT** needs to be Communicated?



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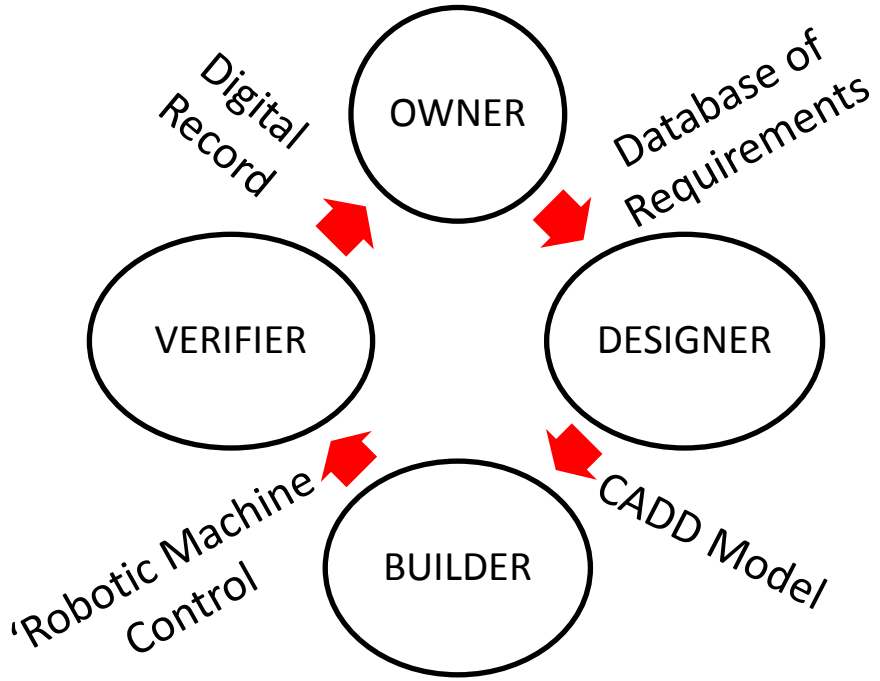
WHY DO WE NEED TO 'CHANGE'?

HOW will digital Improve Communications?



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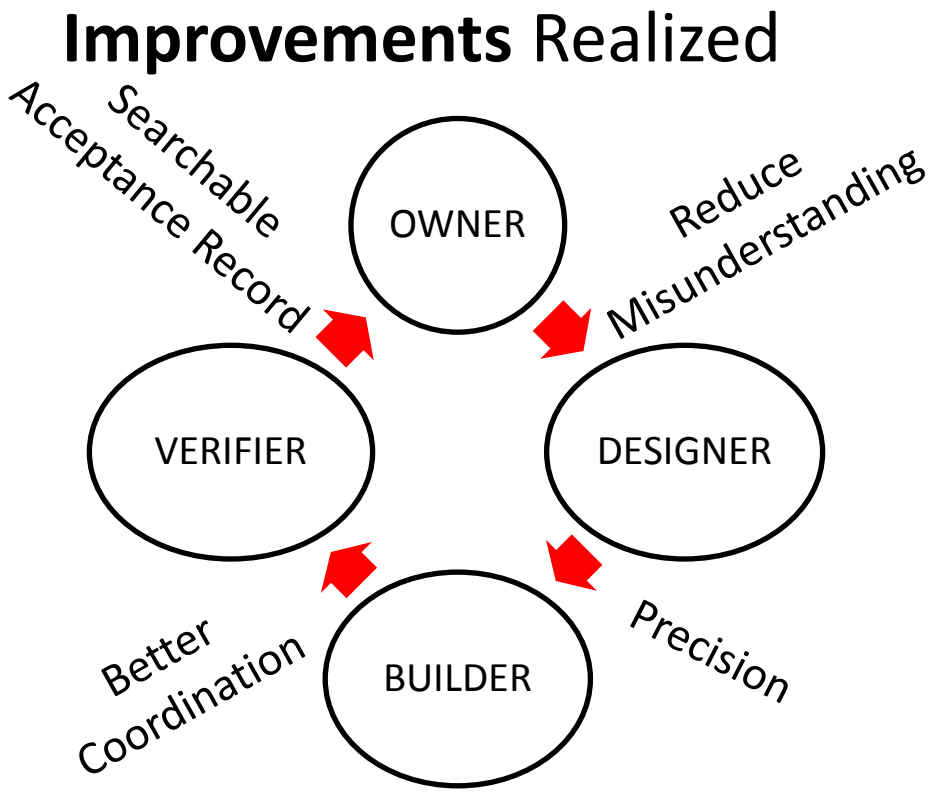

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HOW DO WE DO THIS?

Communicate requirements in a database format as opposed to a ‘novel’ format

Deliver the design to the builder as a CADD model and let them figure out the best way to communicate it to their workers.

Leverage new technology to build with robotic precision where possible

Embrace GPS enabled data collectors instead of hand written forms.

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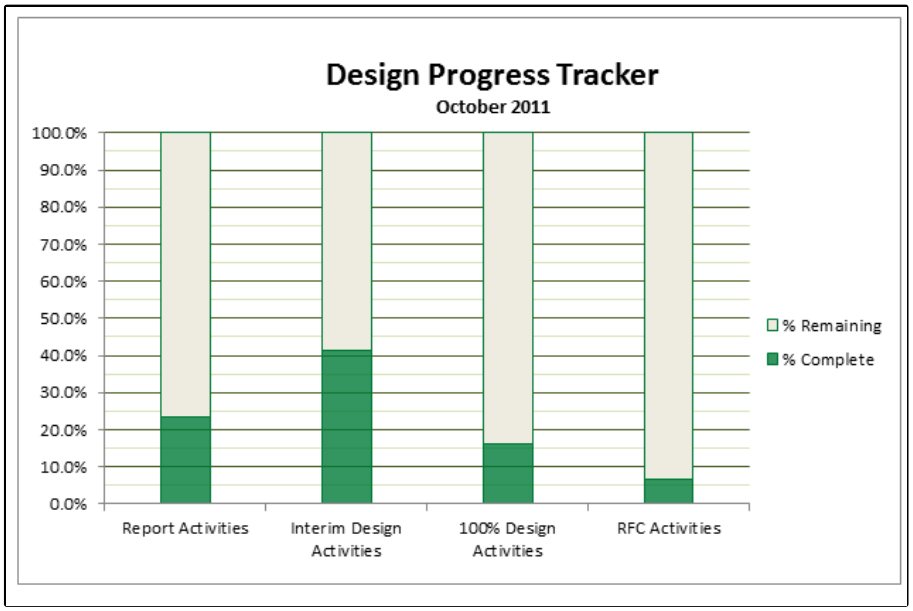
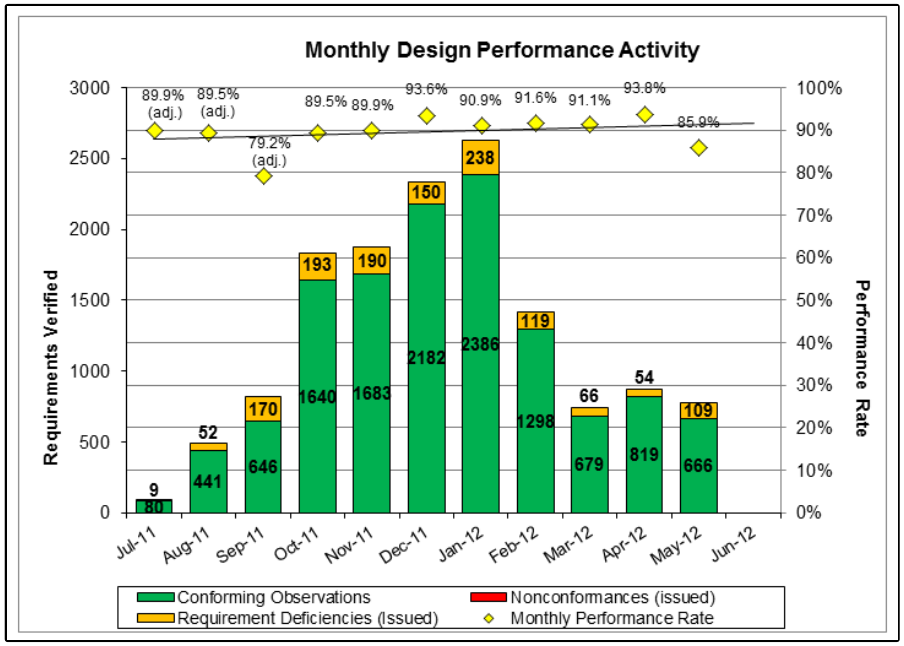


PROGRESS

PERFORMANCE



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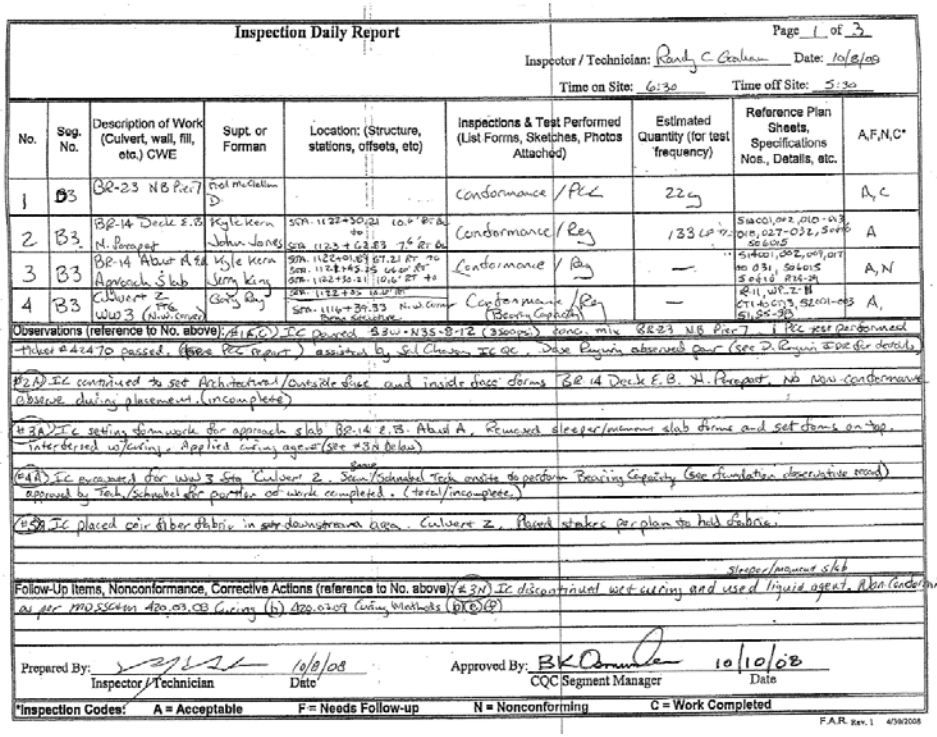
In Construction…



Inspection Daily Report

Page 1 of 3

Inspector / Technician: Randy C Graham Date: 10/8/08

Time on Site: 6:30 Time off Site: 5:30

No.	Seg. No.	Description of Work (Culvert, wall, fill, etc.) CWE	Supt. or Forman	Location: (Structure, stations, offsets, etc)	Inspections & Test Performed (List Forms, Sketches, Photos Attached)	Estimated Quantity (for test frequency)	Reference Plan Sheets, Specifications Nos., Details, etc.	A,F,N,C*
1	B3	BR-23 NB Pier 7	Hal McClellan D		Conformance / PCC	22cy		A, C
2	B3	BR-14 Deck E.B. N. Parapet	Kyle Kern John Jones	Sta. 1122+30.21 to Sta. 1123+62.83	Conformance / Rey	133 LF	S14001, 002, 010-013, 026, 027-032, S0605	A
3	B3	BR-14 Abut A Approach Slab	Kyle Kern Jerry King	Sta. 1122+01.89 to Sta. 1122+45.25	Conformance / Rey	—	S14001, 002, 009, 017 to 031, S06015 S06110 R26-29	A, N
4	B3	Culvert 2 - Wing 3 (N.W. Corner)	Gary Ray	Sta. 1116+39.33	Conformance / Rey (Bearing Capacity)	—	R11, WP-2-11 CT145013, S2601-003 S1, S5-9B	A,

Observations (reference to No. above): (#1 & C) IC present 3 3/4"-N35-8-12 (3500psi) conc. mix BR23 NB Pier 7. 1 PCC test performed -ticket #42470 passed. (See PCC report.) assisted by S.I Chasen IC QC. Dave Pinyan observed pour (see D. Pinyan IDR for details.

#2A) IC continued to set Architectural/outside face and inside face forms BR 14 Deck E.B. N. Parapet. NO NCR conformance observe during placement. (incomplete)

#3A) IC setting formwork for approach slab BR-14 E.B. Abut A. Removed sleeper/remnant slab dirme and set forms on top. Interfered w/curing. Applied curing agent (See #3N below)

(#4A) IC accepted for Wing 3 Sta "Culvert 2. Stem/Schnabel Tech onsite to perform Bearing Capacity (See simulation observation report) approved by Tech/Schnabel for portion of work completed. (Total/incomplete.)

#5A) IC placed coir fiber fabric in ~~set~~ downstream area. Culvert 2. Placed stakes per plan to hold fabric.

Follow-Up Items, Nonconformance, Corrective Actions (reference to No. above): (#3N) IC discontinued wet curing and used liquid agent. Abut A (sleeper/remnant s/b) as per MDSSCation 420.03.08 Curing (b) 420.0709 Curing Methods (D)(E)(F)

Prepared By: Inspector/Technician 10/8/08 Date

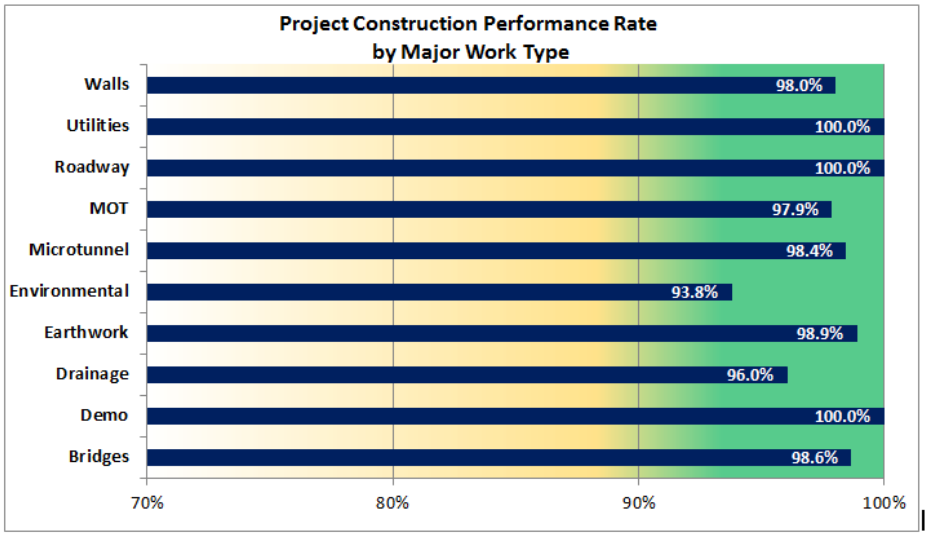
Approved By: BK CQC Segment Manager 10/10/08 Date

*Inspection Codes: A = Acceptable F = Needs Follow-up N = Nonconforming C = Work Completed

F.A.R. Rev. 1 4/30/2008

PROGRESS

PERFORMANCE



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Why do we collect data on …

PROGRESS

- ❑ Claim defense
- ❑ Let SR. management know something is happening
- ❑ Tell the ‘story’ of the project

PERFORMANACE

- ❑ Material test results
- ❑ Satisfy the FHWA
- ❑ Get enough tests to meet frequency guide

Issues with current practice …

- ❑Should be claim avoidance not defense
- ❑Photos worth a 1000 words
- ❑Boxes of paper don't always tell the full story
- ❑Majority of issues result of workmanship, not materials
- ❑Frequency of testing not adjusted for past performance

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Benefits to be realized …

- ❑ Use trained and qualified inspectors to measure performance of work
- ❑ Use time lapsed cameras to monitor progress of work
- ❑ Fewer inspectors more focused on what they are trained to do – inspect completed work
- ❑ Digital photography can provide a full, time-stamped story of how the work was completed – cheaply
- ❑ Tracking performance can highlight areas performing well and areas under performing

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‘Requirements Management’…
What is it???

“generally conforming to Contract requirements”

“**requirement**” = clearly communicated parameter

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From a 'novel'…

702.10 Pumping Concrete

If the Contractor elects to convey concrete by means of pumping, the concrete shall be handled so as to minimize disturbance to the concrete which significantly alters the properties of the concrete being pumped, especially the loss or variability of the air content. The pumping equipment shall be mechanically sound, suitable in kind, and adequate in capacity for the proposed work. The concrete shall not be pumped through aluminum or aluminum alloy pipe. All pipes used for pumping concrete shall be kept clean and free from coatings of hardened concrete. Pump lines shall not rest directly on epoxy coated reinforcing bars. The pumping equipment shall be located such that operational vibrations will not damage freshly placed concrete.

When placing concrete directly from a truck mounted boom, the concrete pump lines shall have a flexible end section at least 10 ft (3 m) long. Methods of placement shall be such as to result in a steady and continuous discharge. If necessary, this may require the use of a restrictive device at or near the end of the discharge tube, the laying the flexible end section horizontally, or other means. For the initial placement of concrete pours which are predominantly vertical, the discharge end of the flexible end section shall be within 2 ft (0.6 m) of the bottom of the pour.

The Contractor shall submit a description of the pumping procedures which it intends to use, and shall notify the Engineer as to the pumping procedure at least 24 h in advance of concrete placement.

702.11 Cold Weather Concrete

When it is necessary to place concrete at or below an atmospheric temperature of 35°F (2°C), or whenever it is determined that the temperature may fall below 35°F

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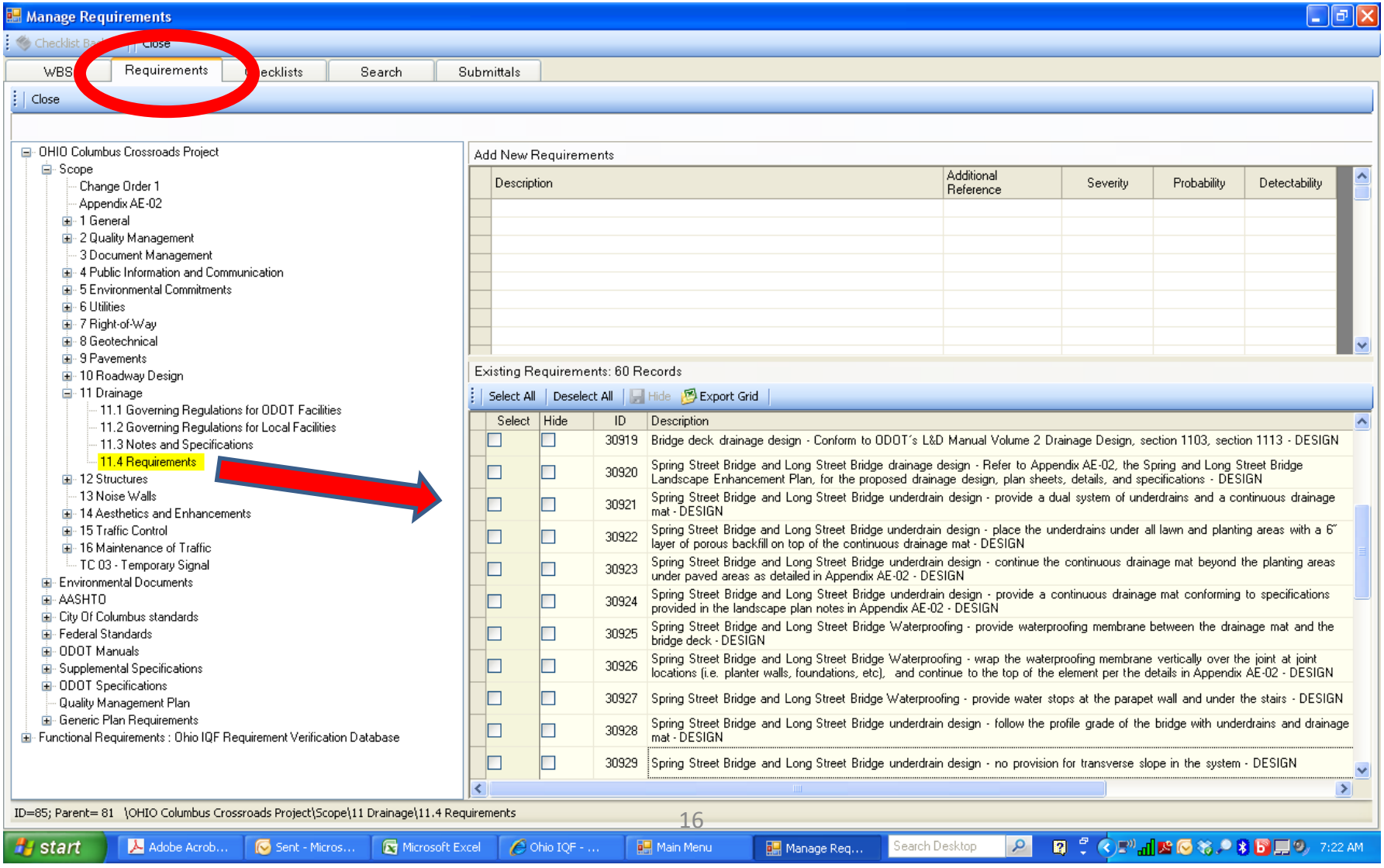
To a Database.



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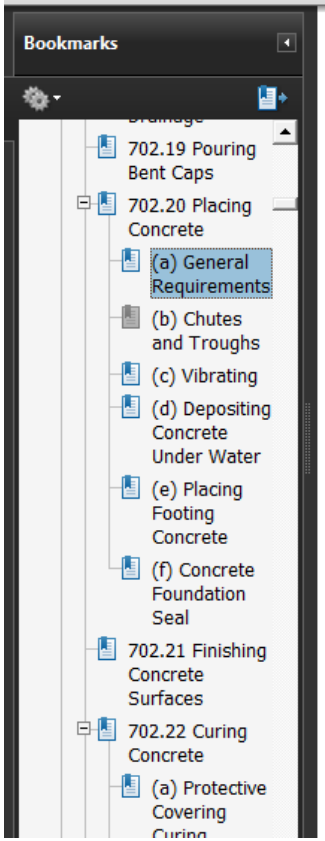
Traditional Approach…

Section 700 – Structures – 233 pages

How many requirements????



(b) Chutes and Troughs

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. Where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that reverse the direction of movement. Open troughs and chutes shall extend as nearly as possible to the point of deposit. Equipment made of or coated with aluminum alloys shall not be used to transport concrete. Pumping of concrete shall be in accordance with 702.10. When the discharge must be intermittent, a hopper or other device for regulating the discharge shall be provided. Placement of supplementary bins or hoppers may be ordered above the point where concrete is being deposited. The concrete shall be allowed to accumulate in these containers in considerable quantity and shall be discharged immediately through pipes extending from the bottoms of these bins or hoppers. All chutes, troughs, and pipes shall be kept clean and free from coatings of hardened concrete. The water used for flushing shall be discharged clear of the concrete already in place.

Concrete shall not be dropped in the forms a distance of more than 5 ft (1.5 m) except when confined by closed chutes or pipes. Each part of the form shall be filled

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Requirements Management Approach…

Identify individual requirements into a table format

		phase
	Technical Provisions	
1	3 DESIGN QUALITY ASSURANCE, QUALITY CONTROL, AND OVERSIGHT	
2	3.1 Designer Responsibilities	
3	Developer shall verify pertinent dimensions in the field prior to the review of Design Documents, Plans, and Construction Documents.	design
	Design Documents, Plans, and Construction Documents shall be subject to IFA's Design Review before beginning construction work covered by the Plans, and shall not be thereafter amended or altered without the prior approval of Developer's Designer and subsequent Design Review by IFA.	design
4	3.2 Developer's Design Organization and Obligations	
5	3.2.1 Designer	
6	Developer shall appoint a suitably qualified and experienced Designer,	management
7	3.2.2 Location of Developer's Designer	
8	the Key Personnel shall be assigned primarily to the Project Office	management
9	3.2.4 Lead Engineer	
10	Developer shall designate and assign a Lead Engineer to manage all Work performed by Developer's Designer (Lead Engineer).	management
11	The Lead Engineer shall be located in the East End Crossing vicinity as required for the Design Work,	management

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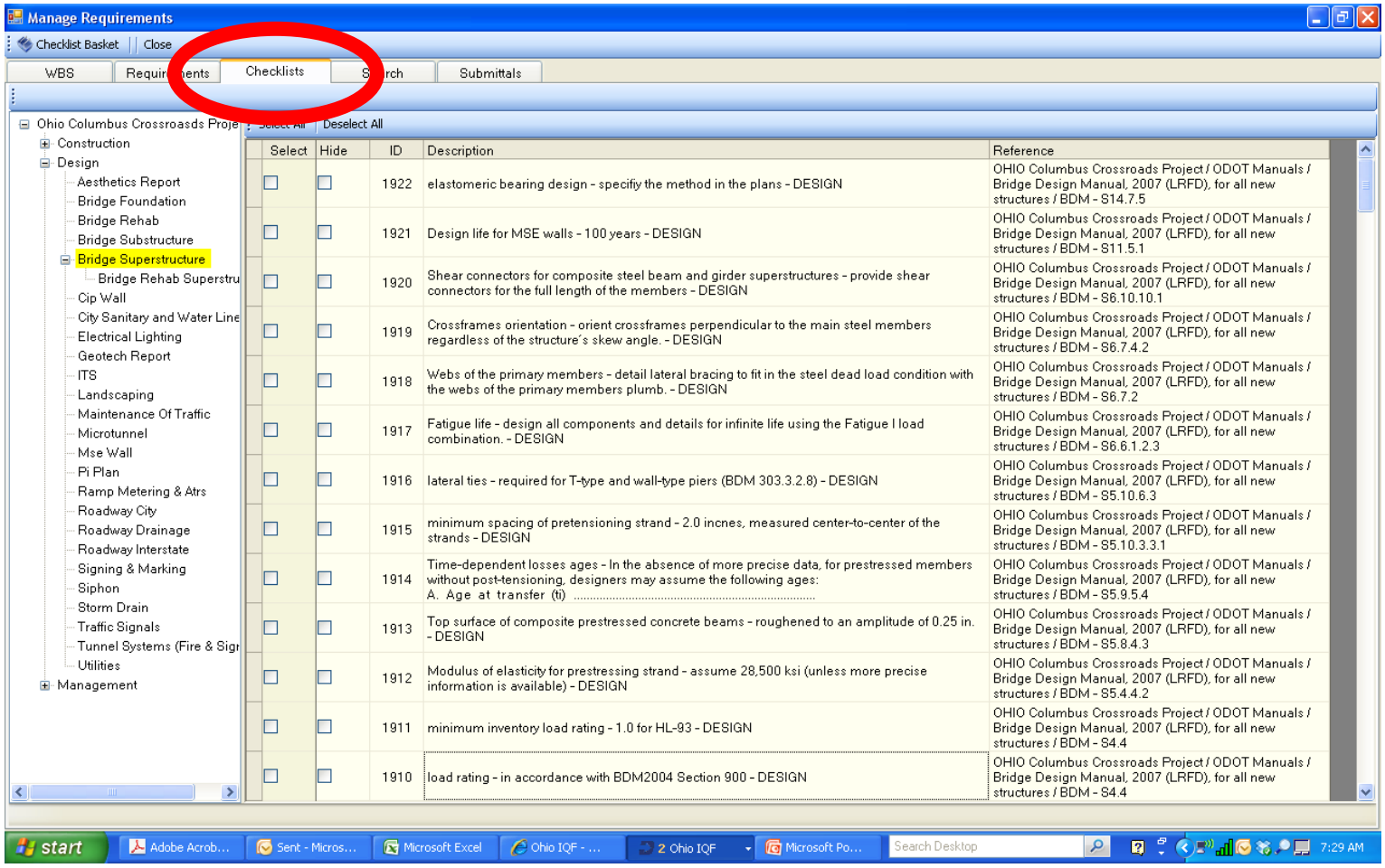
Build a database of requirements…

Dynamic checklists of discipline specific requirements



Assign attributes to requirements…

- Tactical level RISK
- PHASE of project delivery
- OWNER – applicable jurisdiction
- Estimated COST
- VERIFICATION responsibility
- Others…

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Requirements Management Approach…

Benefits to be realized …

- ❑ Apply relevant attributes to requirements
- ❑ Measure performance over time
- ❑ Consistency in requirement selection and verification
- ❑ Reduce risk of misunderstanding expectations

Summarize Take Away Points…

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2. Progress VS Performance
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Contact Information…

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